1957

Stability and progress in the aircraft industry : an inquiry into the factors, favorable and unfavorable, to stability and progress

Robert Carl Clark
University of the Pacific

STABILITY AND PROGRESS IN THE AIRCRAFT INDUSTRY: AN INQUIRY INTO THE FACTORS, FAVORABLE AND UNFAVORABLE, TO STABILITY AND PROGRESS

A Thesis

Presented to

the Faculty of the Department of Economics

College of the Pacific

In Partial Fulfillment

of the Requirements for the Degree

Master of Arts

---

by

Robert Carl Clark

June 1957

TABLE OF CONTENTS

CHAPTER		PAGE
I.	STABILITY AND PROGRESS.	1
	Introduction.	1
	Importance of stability	1
	To aircraft manufacturing industry.	2
	Production.	2
	Cost reduction.	2
	Employment.	2
	To individual companies	3
	Earning and dividends	3
	Retention of labor force.	4
	Cost reduction.	5
	To the Federal Government	5
	National defense.	5
	Expenditures.	5
	Taxation.	6
	Renegotiation of contracts.	6
	To the national economy	6
	Local, regional and national impact	7
	Air transportation industry	9
	Private or civilian aviation.	9
	Importance of Progress.	10
	To the industry	10

CHAPTER		PAGE
	Leadership in the economy	10
	Research and development	10
	Relative share of the potential market	10
	To individual companies	11
	Earnings and dividends	11
	Productivity	11
	Meeting competition	11
	To the Federal Government	12
	National defense	12
	Cost reduction	13
	Research and development	13
II.	STABILITY AND PROGRESS	16
	The Current Situation	16
	Evidences of stability	16
	Production	16
	Domestic	16
	Foreign	19
	Sales	22
	Military	22
	Commercial	23
	Private	23
	Earnings	23
	Pre-tax earnings limited	23

CHAPTER PAGE

Contract renegotiation. 24
Evidences of Progress 25
Increased use 25
Military. 25
Commercial. 25
Private 26
Cost reduction. 27
Management. 27
Engineering 29
Purchasing. 29
Volume. 30
Aircraft Industries Association 30
Production. 31
Complexity. 31
Diversity 33
Research and development. 33
National Advisory Committee for Aeronautics 34
Federal Government. 35
Industry. 37
III. FACTORS THREATENING STABILITY AND PROGRESS. . . . 38
Factors Threatening Stability 38
International political situation 38
Government procurement. 39

CHAPTER PAGE

Research and development. 40

Aircraft manufacturers declining position relative to total industry. 42

Factors threatening progress. 44

Shortage of scientists. 44

Government secrecy. 46

Competition 47

Capital requirements. 47

IV. STABILITY AND PROGRESS. 50

The foreseeable future. 50

Governmental activities 50

Military procurement. 50

Planes. 50

Missiles. 51

Research and development. 52

Commercial aviation 53

Transition to jets. 53

Helicopters 54

Freight and mail. 55

Private aviation. 55

Slight increase in sales. 56

Hillar's "flying platform". 56

The Atom and man. 56

CHAPTER I

THE IMPORTANCE OF STABILITY AND PROGRESS

Introduction. Stability and progress are among the most important factors for study in an economic analysis of the aircraft manufacturing industry. Stability of an industry of such critical importance reduces the extreme dislocations associated with a free enterprise economy during business cycle fluctuations. Stability contributes to the maintenance of a high level of gross national product, employment, and income at local, regional and national levels of the economy. In addition, stability is essential to progress and is, therefore, of vital concern to the aircraft manufacturing industry, individual firms, the Federal Government, and the economy as a whole. Progress is required at a pace sufficient to maintain the healthy competitive situation existing within the industry at the present time. In addition, progress is necessary to assure the highest attainable degree of national security. Furthermore progress, as measured by the gross national product, should annually advance rapidly enough to insure adequate investment opportunities and unhindered expansion of the national economy. In a dynamic free enterprise economy, attainment of stability and progress simultaneously is exceedingly difficult to achieve.

This nation's economic well-being and national security dictate that stability and progress be maximized in the foreseeable future.

Stability. Stability is important to various elements in the national life: the aircraft industry, the individual aircraft firms, the national defense and the economy as a whole.

Stability is of the utmost importance to the aircraft manufacturing industry because it materially effects production, employment, and the ability to reduce costs per unit of output. Stable production is a necessary prerequisite to the efficient scheduling of output and the maintenance of low unit costs. Instability of demand causes costly starts and stops of the production process, which lead inevitably to increased unit costs and reduced output. Variations in size of plant and equipment, expensive retooling, as well as uneconomic utilization of natural resources result. In case of a military emergency the costly process of retooling adds greatly to the unit cost of output, thus materially increasing the inflationary bias of the economy. For the sake of illustrating this point, one must assume the time element is sufficient to allow retooling to occur. In manufacturing industry generally, labor costs form a substantial percentage of total costs and this is equally true in the aircraft industry.

Through wage disbursements, stable employment has a powerful impact on local, regional, and national economies. At the end of 1954 the aircraft industry was the leading employer and also had the largest payroll of any manufacturing industry in the nation.

Individual companies are concerned with stability from the standpoint of its influence on their earnings, dividends, retention of their highly skilled labor force, and reduction of costs. A reasonable degree of stability of earnings is of great help in long range planning. Stabilized earnings allow a firm to pay dividends on a predetermined basis, thus affording protection to the market value of its securities. In the absence of stable earnings a firm would be obliged to retain a sufficient amount of earnings to provide an operating base in depressed periods. This money would otherwise be paid out as dividends or used for capital goods. In either event the national economy would have benefitted through increased disposable personal income or by increased productive capacity. The average return on invested capital, for members of the aircraft industry, made a slow recovery from the depths to which it sank following the end of World War II. All manufacturing companies had an average net earnings for 1954 of about 7% of sales, while

airplane producers net earnings were 3.7% for the same period.[1] As indicated, net profits were at less than one-half of that percentage averaged by U. S. manufacturing industries. The stability of an individual firm may easily determine the type of capital structure it may most efficiently utilize. Debt, retained earnings, equity financing or possibly some combination must be chosen to provide an operating base for current operations and anticipated future expansion. Limitations imposed by insufficient or improper financing may easily impair the firm's position within the industry. Business enterprises able to operate under policies which permit maintenance of adequate financial reserves and working capital, will be in a position to engage in product research and development programs. In addition they will be more capable of retaining their highly skilled labor and maintaining plant and equipment in a state of preparedness necessary to meet any demands. A firm's stability means steady work for its labor force, a feeling of security, and a higher standard of living for the community. Should the production of an enterprise decline drastically for any length of time, its employees would inevitably become

---

[1]Norvin E. Green, "Aircraft Shares Gaining Investment Stature," Trusts and Estates Magazine, XCIV, (June, 1955), pp. 511-514.

unemployed. The technical employees as well as the highly skilled workers would soon be forced to seek employment in other industries. Increased demand, as occasioned by a national emergency, would result in frantic efforts, on the part of individual firms, to recreate its former labor force. In all probability the workers would have dispersed to other areas and some would undoubtedly have lost their proficiency. The task of attracting new workers and training them is a very costly and time-consuming procedure, one which every employer attempts to minimize. Because aircraft companies are highly competitive, any successful method of cost reduction materially strengthens company stability.

The importance of stability of the aircraft manufacturing industry to the Federal Government is illustrated in areas of national defence, expenditure, taxation, and renegotiation of contracts. The ability of manufacturers to expand output in a short period of time, without costly preparations, materially benefits the security of our nation. An unstable industry would be unable to accomplish this task. The Armed Forces would not receive a constant flow of weapons systems (the combination of aircraft, rockets and missiles) at a rate sufficient to assure offensive and defensive security. Government expenditures for military equipment will be substantially lower, due to reduced unit costs, when

production is stabilized. Additional savings may be effected through standardized procurement program. Such an idea is an important condition of many mass producing industries. A stable industry would be in a position to finance its own research and development projects, rather than rely on Government contracts for such purposes. Another value of stability of the aircraft industry is increased and stabilized tax revenue received by the local and national governments. Additional savings may be obtained by reduced indirect subsities, via tax concessions, to unstable producers. These usually take the form of rapid "write off" depreciation allowances and/or lower tax rates. The essential idea of renegotiation of contracts between prime producers and the Department of Defense is to make certain that producers do not make excessive profits or sustain substantial losses. Nevertheless recourse to renegotiation adds to expense and invites some waste. A firm's stability means that military expenditures may be more correctly appraised in advance and a realistic budget may be prepared. Expenditures paid to an unstable firm would cost the government more on a unit basis because the firm would not be benefitting from the economies of stable operation.

The economic significance of stability of the aircraft manufacturing industry is of key importance to local,

regional, and national economies. The Los Angeles area provides an excellent illustration of the impact of the industry on a local economy. According to a survey, in February, 1955, there were approximately 180,000 workers annually employed by six major airplane manufacturers in the Los Angeles area during 1954, or 3,400 more than the previous year.[2] These aircraft workers received $17.5 million in wages and salaries and represented 28.1% manufacturing workers in 1954, compared with 26.1% in 1953.[3] The industry has provided more employment and paid out more in wages than the next three ranking industries; machinery, electrical machinery, and fabricated metal products.[4] Annually the airplane producers purchase one-half billion dollars of goods and services from local shops, merchants and sub-contractors, with the result that induced spending by these suppliers stimulates increased business activity in literally thousands of other enterprises in the area.[5] The Pacific states

---

[2]Aircraft Industries Association, "The Influence of the Aircraft Industry on the Economy of the Los Angeles Area."

[3]Ibid.

[4]Conrad C. Jamison, "The Aircraft Industry: Its Size and Importance in the Los Angeles Economy," Research Department, Security First National Bank of Los Angeles, (September, 1955), pp. 3-5.

[5]Ibid.

of Washington, Oregon, California, Arizona, Nevada, Utah, and Idaho are enjoying the highest level of employment since World War II, due largely to the high employment in the aircraft manufacturing industry.[6] Payrolls for those within the airplane industries in this region approximated one billion dollars or about twenty-five million dollars each week.[7] On a national basis the industry is one of the largest employers and needless to say one of the most costly payrolls. Stability of the industry is of major concern to the thousands of subcontractors and suppliers located in every part of the country. The industry has a backlog of unfilled orders for goods and services of over six billion dollars or a one billion dollar decrease from the previous year. During 1954 employment reached 840,000 wage and salary employees who received $3\frac{1}{2}$ billion.[8] In the same period the industry increased slightly expenditures for goods and services.[9] The industry is the largest purchaser of heat treated sheet, plate and hardened alloys, extruded shapes, rolled bar rods,

---

[6] "Federal Reserve Bank of San Francisco," Monthly Review, (February, 1955), pp. 27-28.

[7] Ibid.

[8] Aircraft Industries Association, Planes, Washington, D. C., XI (January, 1955), 4.

[9] Ibid.

and other structural shapes. The air transportation industry is dependent on the aircraft manufacturing industry for fast, safe, and efficient planes. At the same time the commercial air fleet - passenger and cargo - provides a second line of national defense, as all commercial planes are available, on a standby basis, for immediate use by the Armed Forces in case of a national emergency.[10] The importance of stability of aircraft producers to civilian aviation is that it results in new uses, more efficient planes, and reduced operating costs. The term civilian aviation embraces all phases of flying except military and commercial. Civilian flying is done primarily by business enterprises and individuals. The advantages to this group include tax deductions - initial cost and operation - as a business expense and the fact that costs per passenger mile are reduced below commercial airlines, thus affording economies that cannot be neglected. The aircraft manufacturing industry is constantly attempting to develop new uses for their products in an attempt to stabilize their annual output. Stability of prime producers in turn goes a long way toward stabilizing the operations of many related industries resulting in a beneficial induced secondary reaction on the local, regional,

---

[10] Air Power In An Age of Peril, A Report to the American People Prepared by the National Security Commission, (Indianapolis: The American Legion, 1954), p. 12.

and national economy.

Progress. Progress is of the utmost importance to the industry, individual firms, the Federal Government, and the national economy. The industry must continually make advances in order to remain a leader in our economy. The demands, which are continually being created, for different types of vehicles dictate that a great deal of progress be registered annually. Military demand is determined by the respective departments of our Armed Forces. The various branches of the services determine plane performance requirements and the job of creating a vehicle is up to the prime producers. In the case of commercial and civilian aircraft the industry designs the end product and then proceeds to merchandise its merits to potential purchasers. Behind each degree of progress are many man-hours of labor and dollars which have been invested in research and development projects. In the post-war years the growth of the industry resulted in product and plant diversification. In a dynamic, free enterprise system an industry must progress at the same rate as total industry or lose its relative position or standing. Stated in another manner, the aircraft manufacturing industry must progress at a comparable rate to that of total industry or lose its position as one of the major sectors of our economy. It must at least be able to produce its own requirements

and not have to rely on another industry to produce any item that it requires. An illustration of this point is the fact that the aircraft industry is continually threatened with becoming an appendage of the electronic industry.

The importance of progress to the individual companies within the industry is reflected in their earnings, dividends, share of the market, and product research and development. The keynote to success is progress and this fact is especially true in the aviation business. Earnings are based primarily on sales, however, many other elements such as taxes, insurance, and government renegotiated contracts affect the final net earning figure. Very closely associated with earnings is the dividend policy. Assuming all other factors remain equal, when a firm expands its operations, increased earnings normally occur. A higher dividend policy than formerly prevailed may safely be considered. Generally speaking, as earnings and dividends advance, the value of the firm's securities also rises. Over an extended period of time a company must obtain results based on acceptance of its product or the market price of its securities will decline. To accomplish this feat progress must be achieved and one of the surest means is by increased productivity.

The basic meaning of productivity is best explained by examining the relationship between the physical output or

aggregate price of an item and the number of man-hours or other input items required to produce it. Increased productivity may be accomplished by increasing individual worker efficiency and/or the introduction of labor saving machinery while assuming that output and other cost items remain constant. Depending on the current stage of the business cycle in the national economy, a firm must retain or increase its share of the market in order to be classified as a growth organization. In a fast moving business, such as the aircraft manufacturing industry, failure to achieve growth, immediately results in loss of the individual company's relative position within the industry. The rate of progress registered by a firm is very largely dependent upon the size and scope of its research and development program. History is full of examples of nations, industries, and individual enterprises that have declined or gone out of existence because they failed to engage in research and development projects.

Federal expenditures for National Defense provide the major stimulus for research and development programs relating to airframes, propulsion units, and component avionic, (electronic) equipment. At the present time every airplane manufacturer is engaged in some phase of research and development work.

The Federal Government is vitally concerned with the progress achieved by the aircraft manufacturing industry. The impact of progress is magnified in such a sensitive area as national defense. The national defense effort is materially strengthened by having a modern progressive aircraft industry ready to maximize production on a moment's notice. The industry must achieve technological advances to facilitate production of the weapons systems required in a national emergency. In addition, cost reduction techniques, other than economies associated with mass production must be incorporated in order to achieve reduced costs per unit of production. The new plants which are being constructed as well as those being contemplated in areas of no strategic importance, which incidentally is in keeping with the Federal Government's decentralization program, incorporate the latest technological innovations and result in increased production. Evidence of the importance of progress, by the industry, to the Federal Government is dramatically illustrated by the fact that the Government supports a substantial portion of all basic weapons systems research and development. Research and development expenditures by the aircraft industry in 1951 (the latest year in which information is available) totaled more than $400,000,000, and of this amount six out of every seven dollars came from the

Government.[11] The explanation for such an unusual situation is apparent when one considers the complexity of the problems and the enormous expense involved. Basic or pure research commences at a theoretical level and probes for unknown questions as well as answers, while development is the process whereby new knowledge is used by engineering and industry. Individual firms are understandably reluctant to participate in pure scientific investigations with their own capital, especially since their percent of net income to sales is so much below the national average for all manufacturers, 3.7% versus 7% in 1954 and 2.3% as against 6.8% in 1953.[12]

On a national basis, as also was pointed out earlier, the industry in 1954 was the leading employer with the largest payroll of any manufacturing industry in the country.[13] The five top employers for the year were aircraft, automobile, steel, communications equipment and broad woven fabric mills.[14]

---

[11] Cawley, T. J., Ben S. Lee, and Rudolf Modley, Aviation Facts and Figures, 1955 (Washington, D. C.: Lincoln Press, Inc., 1955), p. 97.

[12] Standard and Poor, Aircraft - Basic Analysis (Chicago: Standard and Poor Publishing Company), p. A-18.

[13] "Aircraft Industry Is Top Employer in Manufacturing," Planes, X (June, 1954), 1-2.

[14] Admiral DeWitt C. Ramsey, USN (Ret.), The Aircraft Industry, 1954-1955, Aircraft Industries Association of America, Inc. (Washington, D. C.: 1954), p. 4.

Including families of employees, nearly 2,000,000 Americans are directly dependent on the annual aircraft industry payroll of $3,500,000,000 or approximately $1,750.00 per individual.[15] Progress of the industry is of major concern to the 60,000 subcontractors and suppliers, who, incidentally, are located in nearly every American community.[16]

Thus, both the stability and progress of the aircraft industry are very important.

---

[15]"Aircraft Industry Is Top Employer in Manufacturing," loc. cit.

[16]"Where Does America Buy Her Airplanes?," Skyline, XIII (January, 1955), p. 6.

CHAPTER II

STABILITY AND PROGRESS

The Current Situation. The stable level of operations was the most significant aspect of the industry's experience during the 1953-1954 period which in turn provided one of the major supports for the national economy. Current expectations, by the aircraft manufacturing industry, for a continuation of the trend toward stability and progress are the most favorable in its short but turbulent history. An examination of the evidences of these two factors - stability and progress - will constitute the substance of this chapter.

Evidences of Stability. Production declined by only 230 units from the 15,130 planes manufactured in 1953 to 14,900 in 1954.[1] A recent survey made by the Aircraft Industries Association reveals that twenty-eight different airframe manufacturers currently are working on 91 types of aircraft - sixty-five are military and twenty-six are either commercial or civilian models.[2] As older models are discontinued, new ones are introduced, thus assuring steady production of the

---

[1]Aircraft Industries Association of America, Inc., Aviation Facts and Figures, 1955, Lincoln Press, Inc., Washington, D. C., April, 1955, p. 9.

[2]"Aircraft Industry Now Building 91 Types of Planes," Planes, XI (January, 1955), pp. 1-3.

latest and most efficient aircraft. During 1953 the Department of Defense made a decision which introduced a major stabilizing influence on the aircraft manufacturing industry. Goals were established calling for a 137 wing Air Force and a 17 group Naval Air Arm, by June 30, 1957, in addition, the Department of Defense stated these wings and groups would be continuously modernized as more efficient planes were produced.[3] Military production, which represents 85% of the industry's total production was about 10,500 in 1954 compared to 11,000 in 1953.[4] This decline in unit deliveries was foreseen and marks the beginning of the transition from the build-up to the maintenance and modernization phase of the remobilization program.

Commercial aircraft production increased slightly during 1954. American made transports continued to dominate the world as 309 aircraft were produced in 1953 while 325 were delivered in 1954, of which 130 were twin-engined executive types and 195 were in the 36 passenger or larger category.[5]

---

[3] Standard and Poor, Aircraft - Basic Analysis, (Chicago: Standard and Poor Publishing Company, 1956), p. A-18.

[4] Ramsey, op. cit., p. 1.

[5] Ibid., p. 3.

Stability of production of commercial airplanes has been achieved by a relatively stable number demanded and by "custom" production. Because of the high cost of each airplane the manufacturers sell each unit before production commences. There is no finished inventory problem confronting the manufacturers. As a result, any tendency to overproduce is reduced to an absolute minimum. For the present, technological innovations increasing passenger capacity and speeds will restrict the potential number of planes required to handle airline traffic.

Private airplane production declined from 3,825 in 1953 to 3,075 in 1954.[6] On first thought one would normally believe that the manufacturers are headed for trouble, however, this is not the case. Stability of production has been achieved recently by manufacturing larger airplanes. In other words unit volume has declined slightly but the product is larger, therefore sales, earnings and employment have remained stable. Costs of operating executive planes for business purposes, assuming the aircraft is utilized to its maximum and after deducting operating costs and depreciation for tax purposes, becomes competitive with other means of transportation. In addition further savings are achieved

---

[6]Lynn Black, Fred Hamlin, and Eleanor Thayer, The Aircraft Yearbook, 1954, (Washington, D. C.: Lincoln Press, Inc., 1955), p. 32.

when one considers the time of the executive(s). Only recently has the business community become aware of the savings to be effected by the ownership and operation of their own aircraft. The industry was fortunately in a position to meet this challenge by increasing the size, speed, range and comfort of private aircraft, thereby stabilizing production.

Foreign production, which is competitive with that of American producers, is centered in England and Canada. Competition on a very limited scale is found in France, Germany, Italy, Japan and Argentina. The production facilities of the Axis powers were crushed during World War II or by the terms of its conclusions. The Allied nations on the continent all received extensive damage to their aircraft manufacturing facilities. As a result four out of every five commercial airliners built since 1946 has been produced in the U. S. A.[7] England's aircraft industry emerged from the great conflict the least harmed of that of any European country. As a result of wartime research and development on jet engines, England was able to build prototype commercial jet transports several years before anyone else. However, due to production inefficiencies and a tragic series of crashes, the British were prevented from capitalizing on their technological

---

[7] "Aircraft Industry Now Building 91 Types of Planes," op. cit., pp. 1-3.

advantage.[8] The British achievements are directly responsible for providing the stimulus for American manufacturers to enter the commercial jet field years before they had intended doing so.

Canadian airplane manufacturers have traditionally worked in close cooperation with England and the United States. Although not a great deal of information is available on the subject of cross licensing and sales agreements, Canadian firms are believed to have concluded agreements with both American and British firms. In addition to providing Canada's own military requirements a substantial quantity of military planes have been sold to North Atlantic Treaty Organization members.

French aircraft manufacturing was nearly destroyed by World War II. In addition it has been handicapped and retarded by technological developments in other countries, limited budgets, an unstable national economy, and perennial political crisis.[9] The industry specialized in those models or elements in which there was little or no competition. Especially noteworthy advances have been achieved in the development of small piston and jet engines.

---

[8]"Prototype Comet IV Tests Design Changes," Aviation Week, LXII (June, 1955), p. 92.

[9]Ibid.

Axis nations aircraft manufacturing facilities were either destroyed during the war or were dismantled by Allied Occupational forces. Germany was forbidden by terms of the Surrender Agreement to engage in the manufacture or operation of any commercial air transportation system. Italian production facilities were destroyed during World War II. The existing facilities were created through Marshall Plan, Mutual Assistance Pact and other Foreign Aid programs in order that members of the North Atlantic Treaty Organization would be able to purchase parts and modify American equipment.[10] Japan's aircraft manufacturing industry was reduced to rubble. Today the industry is engaged in maintenance work for the U. S. Air Force. At the present time negotiations are being conducted which would allow the recreation of production facilities sufficiently capable of supplying Southeast Asia Treaty Organization members with American designed military aircraft and engines.[11]

Argentina is the only country in Latin America with an aircraft manufacturing industry and is Government sponsored. The industry is producing aircraft for domestic military, commercial and private use. No challenge exists from

---

[10]"Italy's Aircraft Industry Passing Through Its Most Critical Period," Aviation Week, LXII (June, 1955), p. 61.

[11]"Japan Air-Power Coming Back" Aviation Week, LXII (May, 1955), p. 24.

this source because the industry's normal growth has been hampered since its inception by lack of raw materials, technical know-how and political crises.

Stability of American producers has been the result of war, tragic misfortune by British producers and most important of all, by sensible production schedules geared to existing demand both at home and abroad.

Evidence of the stability of sales by the aircraft manufacturing industry is illustrated by total dollar volume, $8,511,000,000 in 1953 compared to $8,600,000,000 in 1954.[12] Analysis reveals that dollar sales increased while unit production declined. The higher cost is reflected in additional instrumentation on latest production models, and the fact that civil, commercial, and military aircraft are of larger design in order to accommodate the additional electronic instruments. Military sales have been stabilized as a result of the Department of Defense decision to maintain a modern 137 wing Air Force. When the build-up is completed and remodernization commences, overall sales will also remain fairly constant. Internal dislocations will be experienced within the industry as various manufacturers obtain sales orders for advanced models, but overall expenditures will assist in the continuation

---

[12]Cawley, Lee, and Modley, op. cit., p. 13.

of the current trend toward stabilization. Sales of guided missiles, to the military, is anticipated to offset any decline in normal aircraft, thus affording an additional stabilizing factor to the industry.

Commercial airplane sales figures are not currently available, however, unit figures have been mentioned earlier in this Chapter. Production is expected to remain slightly above the 300 unit mark until the transition from piston to jet powered aircraft takes place. Deliveries on the jets is scheduled for late 1958 or early 1959.

Private airplane sales for the year 1954 are estimated at $40,000,000 compared to $34,458,000, achieved in 1953.[13] Increased sales coupled with a slight decline in production does not reflect higher prices, as one would normally expect, but to the propensity of business enterprises to purchase twin-engined eight to ten passenger models rather than single-engined four place airplanes.

Earnings stability of the aircraft manufacturing industry is very closely related to the large volume of military business. Pre-tax profit margins on Government contracts are narrow. The Armed Service Procurement Act of 1947 raised maximum profits on cost-plus-fixed-fee projects to 10% before

---

[13]Ramsey, op. cit., p. 3.

taxes on production contracts and 15% on experimental and research work from the 7% level previously in force under the War Powers Act of 1950, however, the Armed Service Procurement Regulation, a direct implementation of the 1947 procurement law specifies that pre-tax earnings shall be no more than 7% on production contracts and 10% on research projects.[14] In addition, the Renegotiation Act of 1948, later revised as the Regegotiation Act of 1951 and subsequently extended through 1958, calls for overall profits of a manufacturer on all Government work for a given year subject to renegotiation.[15] At the present time there is no clearly defined process for determining excessive profits, but of interest are a few of the salient guides such as: contribution of each company to the defense effort, efficiency, extent of the risk assumed, net worth, the amount of capital employed per each contract, and the character of the company.[16] In spite of these handicaps, not encountered by business enterprises engaged in non-Governmental business activities, the pre-tax income of twelve representative airplane producers remained at three hundred seventeen million and three hundred seventy million dollars

---

[14]Standard and Poor, op. cit., p. A-12.

[15]Statement by Mr. F. A. W. Steiffler, personal interview. Aircraft Industries Association of America, Inc., Western Region.

[16]Statement by Mr. Theodore Grant, personal interview. Aircraft Industries Association of America, Inc., Western Region.

during 1953 and 1954 - or a relatively stable level.[17]

Evidences of Progress. We turn now to progress, that second great decideratum.

Evidences of progress of the aircraft manufacturing industry may be observed in the following areas: Increased use of end product, cost reduction, increased production, and research and development.

Increased utilization of the airplane, as measured by any set of standards, has made outstanding advances in the past decade. Domestic scheduled airlines carried 4,046,000 passengers approximately 2,436,800,000 miles at an average passenger revenue of 5.4 cents per passenger mile during 1944 compared to 1954 records of 31,776,000 passengers being carried approximately 26,716,000,000 miles at an average passenger revenue of 5.5 cents per passenger mile. For the same years United States international airlines carried 356,700 passengers 391,300,000 miles at an average revenue of 7.82 cents versus 2,848,000 passengers approximately 6,284,900,000 miles at an average of 6.75 cents per passenger mile.[18] Analysis revealed that despite spiraling higher operating costs domestic airline travel fares remained constant while international operators were able to decrease fares. By way of

---

[17] Standard and Poor, op. cit., p. A-18.

[18] Gawley, Lee, and Modley, op. cit., pp. 63-64.

comparison the Consumer Price Index rose from 76 in 1944 to 114 in 1954.[19] In addition, the quality of service, comfort, and safety achieved by the airlines is virtually incomparable. Increased use of the airplane as a method of transportation, by the business community, continued a growth trend through 1953 which was established after the end of World War II. Each year since 1946 has witnessed a gain in flying time recorded by company owned and operated airplanes. Between 1946 and 1953 the number of hours flown in business aircraft increased by 3.4 times with the most pronounced gains being achieved in the immediate post-war period, however, the 1953 total of 3,626,000 hours versus 3,126,000 in 1952 represented a 16% gain.[20] The Civil Aeronautics Administration Forecast of Air Traffic in 1960 indicated the anticipated annual increase in the Private Sector of flying will be approximately 400,000 hours. Flying for pleasure continues to form a substantial portion of the utilization pattern, ranking second to business transportation. In the four most recent years (1950-1953) for which data is available, flying for pleasure

---

[19] Federal Reserve Charts, 1954, Prepared by the Division of Research and Statistics for use by the Board of Governors (Washington, D. C.: Federal Reserve System, 1954), pp. 102-103.

[20] The Airplane At Work For Business and Industry, A Report Prepared by the Office of Program Coordination, Civil Aeronautics Administration, U. S. Department of Commerce (Washington, D. C. : U. S. Department of Commerce, 1954), p. 8.

has consistently accounted for between one-fifth and one-fourth of the total hours flown in the Private Sector and recorded a 13% increase in the 1,846,000 hours flown in 1953 over the 1,629,000 hours in 1952.[21] Another use of the modern aircraft, thus evidencing progress, is the acceptance of the helicopter by Government agencies, commercial airlines and general public as a fast and efficient method of traveling short distances. At the close of 1954, there were 16,750,000 or approximately 10% of our population living in New York, Chicago and Los Angeles which were served by one of the three of this nation's newest commercial enterprises - independent helicopter airlines.[22]

Cost reduction is a major standard of measuring progress in the aircraft manufacturing industry as well as by executives in all forms of business activities. The importance of cost reduction is dramatically illustrated by J. S. McDonnell, President of McDonnell Aircraft Corp., in an article appearing in the January 1st, 1955, issue of Business Week, "regardless what system a company uses to reduce costs, top management must be constantly informed and take positive steps

---

[21] The Airplane at Work For Business and Industry, A Report Prepared by the Office of Program Coordination, Civil Aeronautics Administration, U. S. Department of Commerce (Washington, D. C.: U. S. Department of Commerce, 1954), p. 8.

[22] "Helicopter Lines Serve 84 Towns, 16 Million People," Planes, X (January, 1954), p. 1.

to keep costs as low as possible or face the inevitable consequences of losing money or being forced out of business." Admiral DeWitt C. Ramsey, President of the Aircraft Industries Association, has repeatedly stated in interviews, lectures and magazine articles that cost reduction procedures in the aircraft industry is not only essential to our national economy, but is also good business for the manufacturers.

Cost reduction in any given operation is normally one of top management's most serious problems and responsibilities, for its control are traditionally delegated from the President downward to managerial and supervisory level. In the aircraft industry, as in many others, strict budgetary controls establish boundaries within which decisions are formulated. The installation of systems, procedures, and their analysis which is in many instances integrated with and/or supplemented by electronic computors, has been most effective in lowering operating costs. Another efficient method has been the exchange of production, technical and manufacturing information within the industry which has been handled through the efforts of Aircraft Industries Association, the National Advisory Committee for Aeronautics, various branches of the Armed Forces, trade journals and other publications, as well as industry-wide conferences. Management also reduces costs by coordination and cooperation on all phases of activity by

the various levels of each department. Continuing campaigns to emphasize cost reduction at all company levels, from the production line to chief executive offices, have been instrumental in reducing variable costs.

Engineering costs within the aircraft manufacturing industry have been and are continuing to be reduced by product simplication, standardization and interchangeability of parts, cost controls, maximum scheduling of work load, rapid dissemination of technical data, and emphasis on advanced training program. In an interview with Mr. E. A. W. Steiffler, of the Los Angeles office of the Aircraft Industries Association, the writer was told that technological advancements are currently being achieved so rapidly that a "top flight" engineer today would be by-passed within a few years if he did not participate in advanced education constantly.

Purchasing costs are being reduced by coordinating company purchases in most economical quantities, stimulation of competition among suppliers, reclamation and waste prevention campaigns. One manufacturer reported savings of $1,500,000 in one year through materials conservation and reclamation programs.[23] Another company lowered purchasing costs as a result of the development, by an industry supplier, of a

---

[23] Economy in Air Power, The Story of the Continuing Campaign to Make the Tax Dollar Buy More Air Power (Washington, D. C.: Aircraft Industries Association of America, Inc., 1953), p. 22.

curved jaw in a stretch forming press which enabled the manufacturer to save $100,000 on a 200 plane contract.[24]

Volume operations tend to reduce costs. Whenever economies of mass production may be achieved substantial savings per unit of output will normally accrue. An illustration of this feature as it applies to one production item - labor is found in the case of an aircraft manufacturing company producing bombers for the Air Force. The 1,000th unit required 7% of the manhours required to complete the first production model and as a result of volume operations, labor costs were reduced 93% per unit of output.[25] Another typical airplane producer reported that the unit cost of a late model jet fighter was reduced 52.3% while the airplane was in volume production, despite the fact wages rose 40.9% and the consumer price index increased almost 20%.[26]

The Aircraft Industries Association of America, Incorporated, in addition to its other functions, is constantly seeking ways and means to reduce costs of its members. As cooperation is required to keep Air Power costs at the lowest possible level, both at the company level as well as at the industry level, the Association acts as a coordinator in

---

[25]"Aircraft Industries Now Building 91 Types of Planes," Planes, XI (January, 1955) p.1.

[26]"Costs Up - Jet Fighter Prices Down," Planes, IX (November, 1953), p. 1.

an effort to "sell" the users of the end product, the industry, and its numerous suppliers, on the value of establishing objectives which would result in considerable savings to all concerned. The following are some of the major programs upon which the Association is currently engrossed: assisting the Government in eliminating unnecessary regulations and reports in addition to simplifying those already in existence; obtaining lower freight rates for aircraft materials and parts commensurate with those charged non-defense products; cooperating with the Armed Forces in developing spares and material requirements; and lastly promoting standardization of parts.[27]

Increase of production is one of the standards used to measure progress in the aircraft manufacturing industry. Progress is most effectively demonstrated by the ability to increase production or maintain constant level of production while manufacturing products of a more complex nature.

The complexity of the manufacturing process is primarily responsible for the difficulty encountered in securing production increases. One must constantly remember the airplane is continually being modified so that in any given production series, hundreds or literally thousands, of design changes may have occurred between the first and last models. An indefinite amount of time is required for military authorities to establish strategic and tactical requirements and to

---

[27]Economy in Air Power, op. cit., p. 24.

translate the information into specific performance specifications. The actual creation of a modern military airplane requires between seven and ten years from initial design to final acceptance.[28] Between two and three years are necessary for design planning, the ensuing competition by the manufacturers, and the actual contract award to be made; followed by three years for construction and evaluation of experimental prototype models; and four years for production, preformance analysis, modifications, and final acceptance trials by the Armed Forces.[29] The production of an aircraft involves literally thousands of inter-related actions. Such a project requires the knowledge and skills of virtually every occupation, and in addition, many months - sometimes years - are needed to construct manufacturing facilities, assemble materials and personnel capable of handling the program. By way of illustrating achievement, the B-52 jet bomber required nine years from initial design to delivery of the first production model. However one such airplane is capable of delivering more destructive power in one mission, in the form of atomic and/or

---

[28] Air Power in An Age of Peril, A Report to the American People by the National Security Commission (Indianapolis: The American Legion, 1954), p. 18.

[29] Ibid., p. 18.

hydrogen bombs, than the combined air forces of all the combatants during World War II.[30]

Progress has been achieved in the many diversified areas of aeronautical endeavors and the American aircraft manufacturing industry has led the world into what has often been referred to as the Age of Wonders. Operational military airplanes break the sound barrier in routine flight. Research planes and missiles have soared to unprecedented heights at speeds only dreamed about a few short years ago. Passenger and cargo carrying capacities have been enlarged and their speeds have been increased. With the introduction of the jet transports in 1958 and 1959, greater advances in service and efficiency will be recorded. Increasing numbers of businesses are turning to ownership of their own airplanes, at marked savings in time and money. The helicopter, which proved its value in Korea for the military, is now being utilized commercially.[31] Production achievements of yesterday have been eclipsed by those recorded today and the pattern will not be broken tomorrow.

---

[30]"Business Aircraft Well Equipped; Ready for Any Emergency Need," Planes, XI (February, 1955), p. 1.

[31]United States Aviation Today, a Report on some of the Outstanding Activities During the Fiftieth Year of Powered Flight (Washington, D. C.: Aircraft Industries Association of America, Incorporated, 1953), p. 1.

Research and development programs are being pursued with such urgency and intensity that future progress seems a virtual certainty. It should be pointed out at this time that research and development activities alone do not constitute progress but act as a means to progress if the results can be effectively utilized either from a positive or negative point of view. At the basis of all human endeavor is the limited amount that is known about the laws of nature. Basic or "pure" research may logically be assumed to establish boundaries and limitations to the rate of technological advancement. However, application of the results of research to design, development and production of aircraft is a logical function of the aircraft manufacturing industry. Aeronautical progress is composed of a continuing series of research and development achievements and as each plateau is reached, new tools and techniques must be created and highly skilled technicians indoctrinated.

The intensive research being conducted today is a highly coordinated effort by the National Advisory Committee for Aeronautics, the Armed Forces and industry. Colleges, universities and other research centers, such as the Stanford Research Institute, have for the last several years been conducting special investigations on a contractural basis in an effort to bridge the gap between knowledge and practical application.

The National Advisory Committee for Aeronautics is involved in pure research and development projects involving aircraft, missiles, propulsion units, communications, and related equipment. Progress in recent years has been notable. When a project is completed, information is made available to the manufacturing industry for their use. Outstanding contributions have recently been scored in areas such as vertical take-off aircraft, nuclear aircraft engines, heat resistant materials, thrust reversal devices for jet aircraft, and aeromedical research. Two developments were recently announced which are certain to become milestones in aviation history. In April of 1955 the N. A. C. A. announced that as a result of a 10-year research program, a "flying platform" had been successfully flown which utilizes a new principal for creating lift and thrust.[32] In June of 1955 the N. A. C. A. announced that it had successfully flown a powered model of a vertical take-off transport airplane.[33]

Expenditures of the Federal Government on research and development programs exceeded two billion dollars and were

---

[32]"The Navy Comes Up With a Real 'Flying Saucer'," Colliers, CXXXV (April, 1955), pp. 30-35.

[33]"N.A.C.A. Flies VTO Transport Model," Aviation Week, LXII (June, 1955), pp. 30-35.

matched by approximately seven hundred fifty-eight million from the aircraft manufacturing industry in 1953, amounts which were relatively unchanged from the preceding year.[34] Nearly 60% of the Government's research and development work is performed by private industry, some 15% at non-profit institutions, and the remaining 25% in Government-owned installations. Although actual statistics are not available, reliable estimates indicate that the Department of Defense is spending as much money on guided missile research and development as it is on related work for piloted aircraft. The problems encountered in guided missile and piloted aircraft research and development are similar, and resulting technological gains may be used in the manufacture of either airplanes or guided missiles. The Aircraft Industries Association of America, Incorporated, estimates that 40% of the prime contractors for guided missiles are aircraft manufacturing companies. Major technical areas of investigation include instrumentation, electronic guidance systems, propulsion units, product dependability, and utilization of new or improved materials. In 1954 the public learned that a rocket-powered guided missile reached an altitude of two hundred sixty miles and attained the incredible speed of five thousand

---

[34] Aviation Facts & Figures, op. cit., pp. 94-97.

miles an hour, and shortly thereafter an experimental Air Force airplane established unofficial altitude and speed records of ninety thousand feet while traveling at sixteen hundred and fifty miles an hour.

The aircraft industry reinvests an unusually high percentage of its sales dollar in research and development. In 1953, the most recent year for which statistics are available, the industry spent $758,000,000 or approximately 12% of dollar sales for this purpose, a slight gain over the previous year. This amount constituted 20.5% of the total research and development expenditures for all industries and the all-industry average amounted to only 2% of total sales.[35] Expenditure of this amount of money and of such a high percentage of sales can only result in positive results and progress. The prime motivating force is not competition but national defense. Our very existence depends upon having the best offensive and defensive weapons. In such perilous surroundings, research and development flourish and progress is rapidly achieved.

---

[35]Standard and Poor, op. cit., p. A-17.

CHAPTER III

FACTORS THREATENING STABILITY AND PROGRESS

Factors Threatening Stability. At the present time several factors exist which threaten the stability of the aircraft manufacturing industry. Of paramount concern is the international political scene. The Government's procurement program is a very closely allied factor. Certain areas need a little discussion. Research and development policies of the Armed Forces warrant a brief analysis and, lastly, the airframe manufacturers declining position relative to total aviation industry production will be discussed.

The international political situation is anything but peaceful and has been aptly described by realistic contemporaries as being a state of cold war. The prospects for real peace, a continuation of the present explosive situation, or all-out war are the key factors which determine the size and rate of growth or decline in our national defense system. The struggle between Communism and Democracy is familiar to all of us. The President of the United States, Dwight D. Eisenhower, has summed up the situation most vividly when he recently stated, "Our very survival as a nation depends upon our instant preparedness to resist aggression."[1] America's

---

[1] Air Power in An Age of Peril. A Report to the American People by the National Security Commission (Indianapolis: The American Legion, 1954), p. 18.

top military planners must maintain air superiority to meet any peripheral or global conflict. The equipment necessary for one type of war is unsuitable for the other; inventories must constantly be kept up to date. What concerns the aircraft manufacturing industry is the speed with which orders may be awarded and cancelled.

Federal Government procurement programs have in the past introduced extreme instability for the aircraft manufacturing industry. Since the beginning of World War I, the industry has had to operate under "feast or famine" conditions. In 1916 total military production was 142 airplanes and 14,000 in 1918, however, in 1920 production was reduced to 256 units and again in 1938 only 1,800 planes were built, but in 1944 there were 96,318 completed; by 1946 production was reduced to 1,669 aircraft.[2] When the Korean War erupted in 1950 the industry was producing 215 planes per month and, as in the previous crises, by herculean effort and a great deal of excess expense, production was increased enough to accomplish the task at hand.[3] With the lesson that air power is also peace power, Congress moved to establish an adequate

---

[2]Aircraft Industries Association of America, Inc., Aviation Facts and Figures, 1955, Lincoln Press, Inc., (Washington, D. C.: April, 1955), pp. 8-9.

[3]Ibid.

Air Force with plans for modernization. The matter of a large and continuing military budget is a public issue and therefore subject to political influence. An element of instability is ever present when politics and politicians enter any given situation. The aircraft manufacturing industry has excellent reason to feel that the present far-reaching procurement program--the best ever put in operation--is one which could easily be done away with at some future date even though such a move might not be in our nation's best interest. Naturally, what concerns the aircraft industry is the rapidity with which military contracts can be awarded and more to the point--canceled. Starts and stops are costly to the individual companies involved as well as the taxpayers. The rapid rate at which technological innovations are being developed requires huge capital investments in new plants and equipment. The equipment usually has a very limited life--that of the production model for which it was designed. If the military should cancel an order before completion of the contract, the company involved would inevitably suffer a loss of capital. In addition, the highly trained labor force, which is hard to get and harder to retain, would seek employment elsewhere.

The aircraft manufacturing industry is currently confronted with an unusual element of instability from an equally unusual source. The official and unofficial attitude by a few

top level administration and military leaders poses a critical problem in the specific area of aeronautical research and development.[4] Trevor Gardner, Assistant Secretary of the Air Force for Research and Development, recently announced that an incredible goal has been established in that this country is attempting to make as much progress within the next five years as was made in the first fifty years of aviation.[5] The Hoover Task Force Subcommittee on Research and Development in the Department of Defense indicate areas for improvement which if acted upon would result in a 25% increase in effectiveness. It states that additional funds are needed to accomplish the task and that failure to provide the required funds would be false and dangerous economy, in that a volume of effort essential to support a successful overall program would not be forthcoming. It also states that the Department of Defense should reassess research and development activities in view of anticipated objectives.[6] The Hoover Commission also suggested several areas for consideration where improvement

---

[4] "Research is the Key to Air-Power," Aviation Week, LXII (June, 1955), p. 102.

[5] Ibid.

[6] "Military Research and Development Lagging, Hoover Charges," Aviation Week, LXII (June, 1955), pp. 15-16.

could be immediately accomplished by proper administrative action by the Defense Department. Mr. Charles E. Wilson, the Secretary of Defense, is the responsible executive for all activities in this area and considerable criticism has been voiced against him. Mr. Wilson has had a long and highly successful career in the automobile industry, one which has traditionally been reinvesting a tiny fraction of sales dollars in research and development. One may only speculate whether or not Mr. Wilson really grasps the vital importance of pure research and subsequent development projects to progress in the aircraft manufacturing industry. An old adage, which is fundamental to all phases of science as well as manufacturing, is that today's research is tomorrow's product.

Another problem that has recently come to light is the decline of the air-frame manufacturing industry in relation to the production of total aviation products. Unless this situation is corrected in the near future the prime producers are headed for serious economic and financial difficulty. The cause of the problem is basically that rapid technological advance, in the years since World War II, has progressively increased the complexity of the modern airplane. Frequently the complex new component is manufactured by a newcomer to the industry. The airframe manufacturers may permanently lose the construction of the component in question or worse still,

the newcomer may establish himself as a prime producer. The The prime contract is awarded to the company with the largest dollar contract for the entire aircraft or guided missile. Through lack of experience the weapons system (aircraft or guided missile) could conceivably fail to function properly. Engines are now more complex, as the demand for more power and thrust hastened their development. At the end of World War II piston powered engines were adequate. However, today there are piston, turboprop, turbojet, ramjet and rocket engines. Rockets and guided missiles have proved their capabilities and as a consequence are being developed and produced in ever increasing numbers. Helicopters have proved to be of immense value and as a result, an insatiable world wide demand exists for this type of aircraft. The electronic industry has also contributed immensely to the complexity of modern aircraft. The airplane industry is undergoing a tremendous structural change due to invasion by outside firms. Prime producers do not control aircraft design and production as they did only a few years ago. The immediate demand for growth of guided missiles, power plants, and control and guidance systems required for our national defense program resulted in this allegedly dangerous situation. The manner in which weapons systems contracts have been awarded appears to have caused considerable unrest within the industry. Business enterprises recently receiving <u>prime</u> aircraft contracts include

an elevator manufacturer, a dental supply company, an appliance firm, a mining concern, and a shoe machinery company. However competent they may prove to be in the development of some special component, the award of a prime military weapons system contract seems unwise. Assuming their performance on previous contracts was of the highest quality, it hardly seems likely that they are qualified to assume the general responsibility for the research, development and production of such a highly complex item as a modern aircraft. The only valid argument thus far presented for such a program of awarding prime airplane contracts to companies outside the aircraft manufacturing industry is that by doing so, the great and near-great organizations would be spurred on to develop more efficient weapons systems. The dangerous fallacy of this proposal is, it is asserted, that as long as contract renegotiation exists, profit margins of airplane producers will be kept low. Thus the producers will be unable to pay reasonable or even comparable dividends to stockholders, reinvest in plant and equipment, or adequately engage in research and development projects with their own funds.

Factors Threatening Progress. Of the several factors threatening progress of the aircraft manufacturing industry the current and near-term lack of scientists and other highly trained technicians is the most serious. Other industry factors

which could in the future, or which currently, exert a negative influence, are Government secrecy, intense competition, the magnitude of the amounts of new capital required, rising costs, and limited demand from commercial and private areas of aviation.

The current shortage of scientists and highly trained technicians poses a threat to continued progress of the aircraft manufacturing industry. At the present time the industry is the backbone of our nation's, as well as a large portion of the free world's, Air-Power, which in turn is the backbone of our national security program and that of our allies. In short, the lack of engineers, scientists and other specialized personnel endangers the very future of the free world. The next war, should there ever be one, may possibly be lost in the laboratories years before the storm clouds develop. The United States graduated 30,000 engineers in 1952, 24,000 in 1953, and 19,000 in 1954 compared to an estimated number of engineers in the Soviet Union of 30,000 in 1952, 32,000 in 1953 and 35,000 in 1954.[7] In the last three years Russia educated 24,000 more engineers than did the United States, or looking at it in another fashion, Russia gained the same amount of engineers that were graduated in the United States in 1953. Add to this picture the

---

[7]Aviation Facts and Figures, 1955, op. cit., p. 91.

figures for technicians--those who assist engineers and scientists. Russia maintains 3,700 schools whose present enrollment is about 1,600,000 students versus 1,000 schools with an enrollment of 50,000 in this country.[8] The need for more engineers and scientists perhaps may best be illustrated by the rising number of engineering manhours to bring a new operational jet fighter to its first flight. A World War II fighter plane became airborne after 110,000 engineering manhours of effort compared to 1,340,000 on a recent model.[9] Both planes were manufactured by the same company.

Government-imposed secrecy restricts progress in the aircraft industry. The most certain manner to benefit from technological achievements is to have rapid dissemination and widespread utilization of this knowledge. Due to the relatively few engine manufacturers and consequently limited models being produced, frequent overlapping of interest areas occurs between military, commercial and private users. Commercial and private airplane manufacturers are forbidden to discuss preformance specifications with prospective customers if a military version is on the classified security list. Admittedly the sales job is immediately made more difficult. The same policy holds true in all phases of aircraft parts

---

[8] "Scientist Shortage Threatens Defense," Aviation Week, LXII (March, 1955), p. 31.

[9] Ibid.

and equipment. The industry is in an embarrassing position of not being able to do anything about the problem because military orders form such a large portion of total business. A realistic appraisal of Governmental regulations, red tape and secrecy by a non-partisan body similar to the recent Hoover Commission investigations would be welcomed by the aircraft industry.

The intense competition prevailing among airplane producers is not apparent to the layman in prosperous times. Only when an industry-wide recession occurs and mass unemployment results does the public become aware of the true situation. The aircraft industry's internal structure has changed many times in the last fifty years. The trend has been toward concentration of power and influence in the hands of a few dominant producers through mergers, sell-outs and bankruptcy. The large amounts of capital required to enter the industry restricts newcomers. This intense competition between the few is seen by some to threaten as well as to serve progress. The fact that the industry is not self-sustaining on commercial and private business is an additional handicap to progress.

Capital expenditures for plant and equipment necessary to maintain economical production facilities are tremendous. Technological advances result in costly obsolescence requiring

that equipment be immediately replaced if efficient production is to be maintained. Earnings on sales have been consistently below the national average for all manufacturing industries. A larger proportion of earnings have been retained and reinvested in additional plant facilities in order to be less dependent on equipment leased from the Government. Earnings of the industry are subject to a number of profit control measures such as renegotiation, price redetermination, and various other means. Most Air Force production contracts specify profit margins on sales before taxes, should not exceed 7%. The aircraft industry requires a profit margin considerably higher than the current level if it is expected to engage in research and development projects, as well as expand production facilities with its own capital whether or not it resorts to debt or equity financing. The main reason being that the industry is currently engaged in research and development programs that are far more costly than that of other types of manufacturing industries. In addition, the airplane producers are anticipating an increase in foreign sales which must be allowed to rise in areas of Government contracts if the industry is to become self-sufficient. Otherwise it will remain dependent on Governmental contracts, a situation not in keeping with the basic principles of American business.

As previously mentioned, the Department of Defense,

the Industry, and the Aircraft Industries Association have suggested and placed in operation several realistic and far-reaching programs, which, it is hoped, when completed will contribute a great deal toward both stability and progress.

CHAPTER IV

STABILITY AND PROGRESS

The Foreseeable Future. Stability and progress within the aircraft manufacturing industry are attainable in the foreseeable future. However, not without internal changes and crises at the company level due to the introduction of new technological innovations and the ever present element of competition. No decrease in military demand is foreseen. On the contrary, as airplane purchases decline, guided missile procurement programs are expected more than to offset the decline, so that the overall expenditures will gradually increase. Commercial and private demand are expected to increase. Re-equipment buying by commercial airlines in anticipation of the jet plane era, coupled with rising interest by the general business community, virtually underwrites near-term stability and progress for the aircraft industry.

Future military programs--research, development and procurement--may be expected to continue to exert the most direct influence on the industry. During 1956, initial equipping of the 137 wing Air Force is expected to be practically completed, after which time it is anticipated airplane production will decline to a rate based on normal replacement

due to attrition and modernization.[1] Army and Navy requirements will follow the same pattern, barring unforeseen developments. The Air Force alone will require an annual six billion dollar budget for maintenance and modernization of its 137 wing force.[2] Within the next few years guided missiles will be capable of performing some of the functions of piloted aircraft, resulting in a reduction of military airplanes. As piloted aircraft are replaced by guided missiles, by the Armed Forces, total expenditures are expected to rise somewhat. The dollar amount depends on the number and cost of planes replaced against the number and cost of guided missiles. If the answer is known, one may rest assured that it is highly classified information. One may assume with confidence that total military requirements will continue contributing to the stability and progress of the aircraft manufacturing industry for many years.

The guided missile program is destined to play an ever increasing role in defense structure of this country as well as the nations of the free world. Military secrecy prevents dissemination of a great deal of information to the public.

---

[1]Aircraft Industries Association of America, In., Aviation Facts and Figures, 1955, (Washington, D. C.: Lincoln Press, Inc., April, 1955), p. 36.

[2]"Plane Procurement," Aviation Week, LXII (June, 1955), p. 11.

The first large scale production orders were placed in 1953. Since the end of World War II the U. S. Department of Defense has invested over 4.2 billion dollars on our guided missile program.[3] The current demand for various types of missiles is very great because of their strategic, tactical and defensive characteristics. In the years to come demand will be increased because their utilization will be less costly than piloted weapons systems, especially when the human factor is taken into consideration. In addition, the necessity that the U. S. supply our allies with these invaluable missiles will add greatly to overall demand.

Research and development programs are increasing in numbers and scope. The Armed Forces of this country are well aware of the necessity for maintaining qualitative military superiority and know only too well the key to this superiority lies in continued research and development of all phases of weapons systems. The government, through the National Advisory Committee for Aeronautics, has established an organization whose primary function is to engage in pure research and development activities, specializing in problems requiring solution to enable the industry to design and construct airplanes and missiles with performance substantially in excess

---

[3] "Research Today on Guided Missiles Equals That on Piloted Airplanes," Planes, X (July, 1954), p. 4.

of the finest production models in existence. Typical of success thus far achieved was the historical flight in 1954, of a vertical take-off airplane which was the cumulation of ten years research. Known areas of current investigations include radical airframe configuration, control and guidance systems, elimination of the thermal barrier, various propulsion units, application of nuclear energy to aircraft and space craft.[4] Coupled with efforts of the aircraft manufacturing industry, the benefits derived by such a far reaching endeavor cannot but contribute to underwriting aviation progress, national security, and mankind's own achievement.

Future commercial aviation progress is anticipated in sharp increases in passenger, freight and mail service. The aircraft manufacturing industry stands to benefit materially through stabilized production and earnings from increased commercial demand over the next few years. Commercial airlines expect to carry 87,000,000 passengers over 27,000,000,000 miles annually by 1965.[5] In addition, both scheduled and non-scheduled airlines plan to incorporate helicopters and convertiplanes into their network in order to provide better service in remote or inaccessible areas. They hope to increase

---

[4] Aircraft Yearbook, 1954, Aircraft Industries Association of America, Inc., Lincoln Press, Washington, D. C., 1955, pp. 209-214.

[5] "Airlines Capturing U. S. Travel Market," Planes, X (September, 1954), p. 1.

traffic in highly populated metropolitan areas, and to increase business in the short haul area - under 150 miles. Within ten years the aircraft manufacturing industry is expected to be delivering large numbers of helicopters to other independents and the airlines proper. Airline spokesmen have indicated every conceivable method will be utilized to speed up passenger travel time between airport and downtown locations. Convertiplanes, which are still in the developmental stage, are a radical new type of aircraft which have motors that swing from a forward position upward, thereby virtually lifting the plane up and forward simultaneously. If this type of airplane proves feasible, substantial orders, by passenger and freight airlines, will inevitably be placed with the producers for use on "feeder lines" and short haul routes. Improved versions of present piston powered, turboprop and turbojet airplanes will service medium and long haul air routes. Commercial freight carriers anticipate an increase of several hundred percent in the next ten years over present tonnage carried. Air cargo carriers are of the opinion that improved service and utilization of faster, more efficient airplanes will reduce the cost per ton mile below present levels, thus allowing lower rates.

As a result of a recent decision by the U. S. Post Office Department which inaugurated air parcel post service and

the "All Up" policy (first class mail is carried by air rather than surface carrier when room is available) will increase mail tonnage carried by air.

Expectations are that all first class mail moving one thousand miles will go by air after 1960 and that by 1965 all first class mail moving five hundred miles will go by air and thereafter all first class mail moving to any point having an air terminal will be by air transportation.[6]

In the foreseeable future private flying is expected to progress, however not at a pace as great as may be expected of commercial or military aviation. On the other hand manufacturers anticipate stable production and earnings to increase over present levels. Business enterprises undoubtedly will take the initiative in stimulating demand for private airplanes. Business enterprises have learned the benefits of owning tax deductible company planes and have also realized that seat mile costs diminish as passenger miles flown increase. These two factors appear to be the dominant reason for the trend toward larger executive airplanes and their growing numbers. Until an aircraft is developed that is inexpensive to operate and possesses more

---

[6]The Port of New York Authority, Air Traffic Forecast, 1950-1980, A Survey Prepared by the Department of Airport Development, Airport Planning Bureau, The Port of New York Authority, June, 1950, p. 52.

utilitarian value than present planes, there will be no appreciable increase in sales to individuals. Other major limiting factors are the degree of skill and training necessary to fly an airplane and the disadvantage of having to keep one's plane at an airport--usually several miles from home or office. Mr. Stanley Hiller, President of Hiller Helicopters, Incorporated, firmly believes his prototype "flying platform" is the solution to the problem of having an airplane in everybody's backyard - time will tell whether or not the long awaited "tin lizzy" of the air has been developed.

The atom holds many answers to man's problems. The harnessing of nuclear energy to a propulsion unit for use in an airplane would solve a long standing problem in aviation, require minimum fuel consumption and space and possess maximum power. Fission of a single pound of uranium will produce as much heat as burning 2,000,000 gallons of gasoline or 3,500,000 pounds of coal.[9] In comparison, from a storage point of view, the uranium would be one and one-half cubic inches compared to thirty-two railroad cars of coal. An airplane or guided missile powered by atomic energy could easily fly to any spot on the globe and return at supersonic speeds.

When one considers the atoms and jets, pushbuttons,

---

[9]"National Advisory Committee for Aeronautics Expert Sees Urgent Necessity for Research in Aircraft Power Plants," Planes, X (June, 1954), p. 4.

helicopters and "flying platforms", one can, on the one hand, easily visualize a future in which people live rich full lives in harmony and peace. But on the other hand, one can visualize death, destruction and possibly the extinction of the human race. The airplane, a thing of beauty and utility, has become the decisive force for peace or war. Only man can decide its mission.

Man truly stands on the threshold of a new era, one in which it is conceivable that he will launch himself into outer space. The development of an atomic propulsion unit is the latest link in a long chain of events making such an occurance possible.

BIBLIOGRAPHY

BIBLIOGRAPHY

A. PRIMARY SOURCES

1. Books

Bergaust, E. The Next 50 Years of Flight. New York, N. Y.: Harper, 1954.

Black, Lynn, Fed Hamlin, Eleanor Thayer. The Aircraft Year-Book, 1954. Washington, D. C.: Lincoln Press, 1955.

Cawley, T. J., Ben S. Lee, Rudolph Modley. Aviation Facts and Figures, 1955. Washington, D. C.: Lincoln Press, 1955.

Economy in Air Power. A Report Prepared by the Aircraft Industries Association of America. Washington, D. C.: 1954.

Fifty Years of Aviation Progress. A Report Prepared by the National Committee to Observe the 50th Anniversary of Powered Flight. Washington, D. C.: 1953.

Freudenthal, E. E. The Aviation Industry. New York: Vanguard Press, 1940.

Hunsaker, J. C. Aeronautics at the Mid Century. New Haven: Yale University Press, 1952.

The Influence of the Aircraft Industry on the Economy of Los Angeles Metropolitan Area. A Report Prepared by the Aircraft Industries Association, Western Region. Los Angeles: 1954.

The Port of New York Port Authority. Air Traffic Forecast, 1950-1980. New-New Jersey Port District, 1950.

Ramsey, Admiral DeWitt C, USN (Ret.). The Aircraft Industry, 1954-1955. A Report Prepared by the Aircraft Industries Association of America, Inc. Washington, D. C.: 1954.

Ray, J. R. The Story of American Aviation. New York: John C. Winston Company, 1946.

U. S. Department of Commerce. The Airplane at Work for Business and Industry, 1954. Washington, D. C.: U. S. Government Printing Office, 1954.

U. S. Department of Commerce. Statistical Handbook of Civil Aviation, 1954. Washington, D. C.: U. S. Government Printing Office, 1954.

Whitney, Frederick Lamson. The Elements of Research. New York: Prentice-Hall, Inc., 1952.

2. Periodicals

"Aircraft Industry Now Building 91 Types of Planes," Planes, XI (January, 1955), 1-3.

"Aircraft Industry Spends $4 Billion on Contracts, Materials in 1954," Planes, XI (January, 1955), 4.

"Aircraft Industry is Top Employer in Manufacturing," Planes, X (June, 1954), 1-2.

"Airlines Capturing U. S. Travel Market," Planes, X (September, 1954), 1-3.

"Airlines Operate Fleet Equivalent to 35 Air Force Wings," Planes, X (July, 1954), 1-4.

"Airplanes & Missiles," Planes, X (September, 1954), 2.

"Airports Get Set for Traffic Jump," Aviation Week, LXII (April, 1955), 21-23.

"American Built Aircraft Now Operated in 103 Countries, AIA Survey Reveals," Planes, X (September, 1954), 1-3.

"America Produces 90% of Airliners Built Since 1946," Planes, IX (September, 1953), 1.

"Bonn Flies First Powered Plane," Aviation Week, LXII (May, 1955), 41.

"Business Aircraft Well Equipped; Ready for Any Emergency Need," Planes, XI (February, 1955), 1.

"Costs Up-Jet Fighter Prices Down," Planes, IX (November, 1953), 1.

"Good Earnings Needed to Support Production Base," Planes, IX (September, 1953), 1-2.

"Gross Warns Airframe Industry it is Losing Weapons Business," Aviation Week, LXII (March, 1955), 14.

"Helicopter Lines Serve 84 Towns, 16 Million People," Planes, X (January, 1954), 1-2.

"Hiller Unveils Flying Platform," Aviation Week, LXII (April, 1955), 13.

"How Russian Engineering Looked to a Captured German Scientist," Aviation Week, LXII (May, 1955), 27-34.

"Japan Airpower Coming Back," Aviation Week, LXII (May, 1955), 24-26.

"Jet Transport Race Enters Stretch," Aviation Week, LXII (June, 1955), 142.

"Massive Retaliation," Planes, XI (February, 1955), 1.

"Military Research & Development Lacking, Hoover Charges," Aviation Week, LXII (June, 1955), 15-16.

"National Advisory Committee for Aeronautics Expert Sees Urgent Necessity for Research in Aircraft Power Plants," Planes, X (June, 1954), 1-4.

"National Advisory Committee for Aeronautics Tests Lead to Flying Platforms," Aviation Week, LXII (April, 1955), 44-47.

"New Peace Time Peak in Aircraft Exports Reached During 1953," Planes, X (June, 1954), 1-3.

"Perils of Space Flight," Flying, LVI (June, 1955), 31-32 & 71.

"Plane Procurement," Aviation Week, LXII (June, 1955), 11.

"Research is the Key to Airpower," Aviation Week, LXII (June, 1955), 102.

"Research Today on Guided Missiles Equals That on Piloted Airplanes," Planes, X (July, 1954), 4.

"Scientist Shortage Threatens Defense," Aviation Week, LXII (March, 1955), 31-38.

"Soviet Technological Gains," Aviation Week, LXII (May, 1955), 16-18.

"Talbot Gives Dispersal Details," Aviation Week, LXII (May, 1955), 15.

"Trade Secrecy Slows Aviation Progress," Aviation Week, LXII (May, 1955), 37-38.

3. Unpublished Material

The Influence of the Aircraft Industry on the Economy of the Los Angeles Metropolitan Area, A Report Prepared by the Aircraft Industries Association, Western Region. Los Angeles: 1954.